

Table S1 Risk factors for mental health symptoms and executive dysfunction

	Depression		Anxiety		Stress		Executive dysfunction	
	Unadjusted	Adjusted ¹	Unadjusted	Adjusted ¹	Unadjusted	Adjusted ¹	Unadjusted	Adjusted ¹
Urban-rural subgroup								
UU	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
RU	1.32 (0.95, 1.83)	1.10 (0.61, 1.98)	1.56 (1.19, 2.05)**	1.32 (0.85, 2.05)	1.54 (1.06, 2.22)*	1.46 (0.76, 2.80)	1.09 (0.77, 1.53)	0.77 (0.51, 1.16)
RR	1.48 (1.07, 2.05)*	1.02 (0.59, 1.77)	2.00 (1.52, 2.63)***	1.35 (0.77, 2.39)	1.57 (1.09, 2.28)*	1.41 (0.95, 2.10)	1.35 (0.96, 1.90)	0.81 (0.35, 1.84)
Sociodemographics								
Age, y	/	0.99 (0.93, 1.05)	/	0.99 (0.93, 1.05)	/	0.99 (0.95, 1.03)	/	0.94 (0.82, 1.10)
Sex, female	/	1.06 (1.02, 1.10)**	/	1.39 (1.16, 1.66)***	/	1.15 (1.01, 1.32)*	/	0.97 (0.77, 1.21)
Parental education, high school or higher	/	1.14 (0.83, 1.56)	/	0.82 (0.68, 0.98)*	/	1.26 (1.00, 1.58)	/	0.68 (0.55, 0.84)***
Family income, ≥ 50,000 RMB	/	0.87 (0.68, 1.10)	/	0.85 (0.73, 0.99)*	/	0.97 (0.77, 1.22)	/	0.61 (0.39, 0.97)*
Individual behaviors								
Screen time								
Passive screen time, ≥ 2h	/	1.60 (1.22, 2.11)**	/	1.24 (0.81, 1.91)	/	1.23 (0.99, 1.53)	/	1.17 (0.76, 1.78)
Interactive screen time, ≥ 2h	/	1.20 (1.05, 1.37)**	/	1.89 (1.41, 2.54)***	/	1.36 (1.13, 1.64)**	/	1.45 (1.29, 1.62)***
Night sleep duration, short	/	0.93 (0.84, 1.02)	/	1.19 (0.98, 1.45)	/	1.13 (0.79, 1.62)	/	0.74 (0.58, 0.96)*
Physical activity								
Low	/	Ref.	/	Ref.	/	Ref.	/	Ref.
Moderate	/	0.73 (0.38, 1.39)	/	0.78 (0.68, 0.90)**	/	0.64 (0.45, 0.92)*	/	0.80 (0.55, 1.18)
High	/	0.84 (0.71, 0.98)*	/	0.74 (0.51, 1.09)	/	0.69 (0.56, 0.84)***	/	0.85 (0.54, 1.34)

RR, rural hukou and rural school group; RU, rural hukou and urban school group; UU, urban hukou and urban school group.
¹ Adjusted for sociodemographic characteristics (i.e., age, sex, parental education level, and gross family income) and individual behaviors (screen time, night sleep duration, and physical activity).
*P <0.05, **P <0.01, ***P <0.001.
The bold words represent the P values less than 0.05.

Table S2 Adjusting risk factors step by step for mental health symptoms

	Depression		Anxiety		Stress	
	OR (95% CI)	R ²	OR (95% CI)	R ²	OR (95% CI)	R ²
Model 1		0.003		0.010		0.004
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.32 (0.95, 1.83)		1.56 (1.19, 2.05)**		1.54 (1.06, 2.22)*	
RR	1.48 (1.07, 2.05)*		2.00 (1.52, 2.63)***		1.57 (1.09, 2.28)*	
Model 2		0.004		0.010		0.004
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.32 (0.95, 1.83)		1.56 (1.19, 2.05)**		1.54 (1.06, 2.22)*	
RR	1.45 (1.04, 2.01)*		1.98 (1.51, 2.61)***		1.55 (1.07, 2.24)*	
Age, y	0.96 (0.90, 1.01)		0.98 (0.93, 1.03)		0.97 (0.90, 1.03)	
Model 3		0.003		0.013		0.004
Urban-rural subgroups						
UU	Ref.		Ref.		Ref.	
RU	1.32 (0.95, 1.83)		1.57 (1.20, 2.05)**		1.54 (1.06, 2.22)*	
RR	1.48 (1.07, 2.05)*		2.00 (1.52, 2.63)***		1.57 (1.09, 2.27)*	
Sex, female	1.02 (0.83, 1.26)		1.32 (1.10, 1.58)**		1.13 (0.90, 1.42)	
Model 4		0.003		0.012		0.004
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.32 (0.94, 1.84)		1.44 (1.08, 1.91)*		1.6 (1.09, 2.34)*	
RR	1.45 (1.03, 2.04)*		1.81 (1.36, 2.42)***		1.65 (1.12, 2.43)*	
Parental education, high school or higher	0.98 (0.77, 1.26)		0.78 (0.63, 0.97)*		1.11 (0.85, 1.46)	
Model 5		0.003		0.012		0.003
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.20 (0.85, 1.71)		1.58 (1.17, 2.12)**		1.45 (0.97, 2.16)	
RR	1.38 (0.96, 1.97)		1.93 (1.42, 2.62)***		1.54 (1.02, 2.31)*	
Family income, ≥ 50,000 RMB	0.86 (0.68, 1.10)		0.80 (0.65, 0.99)*		1.00 (0.77, 1.30)	
Model 6		0.018		0.024		0.011
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.15 (0.83, 1.60)		1.37 (1.04, 1.81)*		1.39 (0.96, 2.01)	
RR	1.16 (0.82, 1.63)		1.54 (1.16, 2.05)**		1.29 (0.88, 1.90)	
Passive screen time, ≥ 2h	1.71 (1.36, 2.15)***		1.39 (1.14, 1.70)**		1.34 (1.05, 1.71)*	
Interactive screen time, ≥ 2h	1.20 (0.95, 1.51)		1.51 (1.23, 1.87)***		1.30 (1.01, 1.67)*	
Model 7		0.003		0.011		0.004
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.31 (0.94, 1.81)		1.57 (1.20, 2.06)**		1.55 (1.07, 2.25)*	
RR	1.40 (1.00, 1.96)*		2.09 (1.58, 2.76)***		1.66 (1.14, 2.42)**	
Sleep duration, short	0.91 (0.74, 1.14)		1.15 (0.95, 1.39)		1.12 (0.89, 1.42)	
Model 8		0.006		0.011		0.009
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.29 (0.93, 1.79)		1.56 (1.19, 2.05)**		1.53 (1.06, 2.21)*	
RR	1.42 (1.03, 1.98)*		1.98 (1.50, 2.60)***		1.54 (1.07, 2.23)*	
Physical activity						
Low	Ref.		Ref.		Ref.	
Moderate	0.75 (0.57, 0.97)*		0.81 (0.65, 1.02)		0.63 (0.48, 0.83)**	
High	1.00 (0.77, 1.29)		0.85 (0.68, 1.07)		0.75 (0.57, 0.99)*	
Model 9		0.015		0.031		0.008
Urban-rural subgroup						
UU	Ref.		Ref.		Ref.	
RU	1.11 (0.77, 1.59)		1.29 (0.95, 1.77)		1.43 (0.95, 2.14)	
RR	1.11 (0.75, 1.63)		1.32 (0.94, 1.84)		1.38 (0.90, 2.14)	
Parental education, high school or higher	1.13 (0.85, 1.49)		0.82 (0.64, 1.05)		1.23 (0.91, 1.66)	
Family income, ≥ 50,000 RMB	0.84 (0.66, 1.08)		0.83 (0.67, 1.03)		0.95 (0.73, 1.25)	
Passive screen time, ≥ 2h	1.57 (1.22, 2.03)**		1.21 (0.96, 1.52)		1.20 (0.91, 1.57)	
Interactive screen time, ≥ 2h	1.21 (0.93, 1.57)		1.79 (1.42, 2.27)***		1.27 (0.95, 1.69)	

RR, rural hukou and rural school group; RU, rural hukou and urban school group; UU, urban hukou and urban school group.

*P < 0.05, **P < 0.01, ***P < 0.001.

The bold words represent the P values less than 0.05.

Table S3 Interactive effects of urban-rural subgroup and mental health symptoms on executive dysfunction

	Executive dysfunction			
	Unadjusted		Adjusted	
	OR (95% CI)	P value	OR (95% CI)	P value
Model a				
Depression	4.64 (2.43, 8.85)	< 0.001	5.31 (2.01, 14.02)	0.001
RU	0.96 (0.61, 1.50)	0.845	0.73 (0.46, 1.15)	0.171
RR	1.69 (1.09, 2.61)	0.018	1.12 (0.36, 3.46)	0.848
RU*Depression	1.10 (0.52, 2.32)	0.797	0.89 (0.23, 3.50)	0.866
RR*Depression	0.42 (0.20, 0.87)	0.020	0.36 (0.11, 1.17)	0.089
Model b				
Anxiety	3.67 (1.96, 6.85)	< 0.001	4.13 (1.29, 13.3)	0.017
RU	0.95 (0.52, 1.70)	0.852	0.73 (0.27, 2.00)	0.546
RR	1.65 (0.94, 2.93)	0.083	1.26 (0.43, 3.68)	0.673
RU*Anxiety	1.00 (0.48, 2.09)	0.997	0.88 (0.15, 5.26)	0.884
RR*Anxiety	0.57 (0.28, 1.16)	0.122	0.43 (0.16, 1.12)	0.084
Model c				
Stress	2.29 (1.10, 4.77)	0.028	2.52 (0.96, 6.61)	0.061
RU	1.11 (0.75, 1.63)	0.615	0.80 (0.43, 1.49)	0.489
RR	1.38 (0.94, 2.03)	0.103	0.85 (0.35, 2.07)	0.723
RU*Stress	0.76 (0.33, 1.75)	0.521	0.65 (0.27, 1.60)	0.350
RR*Stress	0.75 (0.33, 1.72)	0.498	0.64 (0.30, 1.37)	0.250

RR, rural hukou and rural school group; RU, rural hukou and urban school group.

¹ All models were adjusted for sociodemographic characteristics (i.e., age, sex, parental education level, and gross family income) and individual behaviors (screen time, night sleep duration, and physical activity).

The bold words represent the P values less than 0.05.

Table S4 Simple effects of urban-rural subgroups on executive dysfunction stratified by mental health symptoms¹

		Executive dysfunction		
		OR (95% CI)	z value	P value
Depression state				
No depression				
Urban-rural subgroup				
UU		Ref.		
RU		0.73 (0.41, 1.29)	-1.09	0.277
RR		1.02 (0.35, 2.93)	0.03	0.975
Depression				
Urban-rural subgroup				
UU		Ref.		
RU		0.58 (0.23, 1.52)	-1.10	0.270
RR		0.40 (0.21, 0.75)	-2.84	0.004
Anxiety state				
No anxiety				
Urban-rural subgroup				
UU		Ref.		
RU		0.78 (0.29, 2.13)	-0.48	0.631
RR		1.55 (0.53, 4.48)	0.80	0.422
Anxiety				
Urban-rural subgroup				
UU		Ref.		
RU		0.61 (0.26, 1.46)	-1.11	0.269
RR		0.49 (0.22, 1.08)	-1.76	0.078
Stress state				
No stress				
Urban-rural subgroup				
UU				
RU		0.82 (0.41, 1.65)	-0.55	0.585
RR		0.84 (0.29, 2.39)	-0.33	0.742
Stress				
Urban-rural subgroup				
UU		Ref.		
RU		0.44 (0.16, 1.21)	-1.59	0.112
RR		0.57 (0.20, 1.59)	-1.08	0.281

RR, rural hukou and rural school group; RU, rural hukou and urban school group; UU, urban hukou and urban school group.

¹ All models were adjusted for sociodemographic characteristics (i.e., age, sex, parental education level, and gross family income) and individual behaviors (screen time, night sleep duration, and physical activity).

The bold words represent the P values less than 0.05.

Table S5 Interactive effects of urban-rural subgroups and mental health symptoms on executive dysfunction (imputed data)

	Executive dysfunction			
	Unadjusted		Adjusted	
	OR (95% CI)	P value	OR (95% CI)	P value
Model a				
Depression	4.64 (2.43, 8.85)	< 0.001	5.20 (1.89, 14.27)	0.001
RU	0.96 (0.61, 1.50)	0.845	0.72 (0.54, 0.95)	0.021
RR	1.69 (1.09, 2.61)	0.018	0.98 (0.39, 2.46)	0.969
RU*Depression	1.10 (0.52, 2.32)	0.797	0.88 (0.27, 2.87)	0.828
RR*Depression	0.42 (0.20, 0.87)	0.020	0.37 (0.11, 1.21)	0.101
Model b				
Anxiety	3.67 (1.96, 6.85)	< 0.001	3.64 (1.29, 10.22)	0.014
RU	0.95 (0.52, 1.70)	0.852	0.71 (0.32, 1.58)	0.403
RR	1.65 (0.94, 2.93)	0.083	0.97 (0.38, 2.48)	0.947
RU*Anxiety	1.00 (0.48, 2.09)	0.997	0.94 (0.18, 4.96)	0.939
RR*Anxiety	0.57 (0.28, 1.16)	0.122	0.55 (0.24, 1.27)	0.162
Model c				
Stress	2.29 (1.10, 4.77)	0.028	2.35 (0.83, 6.66)	0.107
RU	1.11 (0.75, 1.63)	0.615	0.78 (0.47, 1.31)	0.348
RR	1.38 (0.94, 2.03)	0.103	0.75 (0.37, 1.54)	0.438
RU*Stress	0.76 (0.33, 1.75)	0.521	0.71 (0.22, 2.31)	0.566
RR*Stress	0.75 (0.33, 1.72)	0.498	0.71 (0.30, 1.71)	0.449

RR, rural hukou and rural school group; RU, rural hukou and urban school group.

¹ All models were adjusted for sociodemographic characteristics (i.e., age, sex, parental education level, and gross family income) and individual behaviors (screen time, night sleep duration, and physical activity).

The bold words represent the P values less than 0.05.

Table S6 Simple effects of mental health symptoms on executive dysfunction stratified by urban-rural subgroup¹ (imputed data)

	Executive dysfunction		
	OR (95% CI)	z value	P value
UU group			
Depression, score ≥ 14	6.21 (3.37, 11.45)	5.86	< 0.001
Anxiety, score ≥ 10	4.69 (1.71, 12.85)	3.00	0.003
Stress, score ≥ 19	2.98 (1.65, 5.40)	3.61	< 0.001
RU group			
Depression, score ≥ 14	4.78 (1.95, 11.72)	3.42	0.001
Anxiety, score ≥ 10	3.33 (1.33, 8.34)	2.56	0.010
Stress, score ≥ 19	1.67 (0.84, 3.33)	1.46	0.143
RR group			
Depression, score ≥ 14	1.91 (0.92, 3.96)	1.75	0.080
Anxiety, score ≥ 10	2.04 (1.39, 2.98)	3.67	< 0.001
Stress, score ≥ 19	1.68 (1.23, 2.31)	3.23	0.001

RR, rural hukou and rural school group; RU, rural hukou and urban school group; UU, urban hukou and urban school group.

¹ Adjusted for sociodemographic characteristics (i.e., age, sex, parental education level, and gross family income) and individual behaviors (screen time, night sleep duration, and physical activity).

The bold words represent the P values less than 0.05.

Table S7 Simple effects of urban-rural subgroups on executive dysfunction stratified by mental health symptoms¹ (imputed data)

		Executive dysfunction		
		OR (95% CI)	z value	P value
Depression state				
No depression				
Urban-rural subgroup				
UU		Ref.		
RU		0.72 (0.51, 1.01)	-1.88	0.060
RR		0.90 (0.39, 2.08)	-0.25	0.801
Depression				
Urban-rural subgroup				
UU		Ref.		
RU		0.61 (0.29, 1.28)	-1.31	0.191
RR		0.39 (0.23, 0.68)	-3.36	0.001
Anxiety state				
No anxiety				
Urban-rural subgroup				
UU		Ref.		
RU		0.76 (0.32, 1.8)	-0.62	0.538
RR		1.08 (0.40, 2.95)	0.15	0.878
Anxiety				
Urban-rural subgroup				
UU		Ref.		
RU		0.64 (0.25, 1.62)	-0.95	0.344
RR		0.50 (0.30, 0.86)	-2.54	0.011
Stress state				
No stress				
Urban-rural subgroup				
UU		Ref.		
RU		0.79 (0.44, 1.41)	-0.81	0.419
RR		0.72 (0.30, 1.73)	-0.73	0.463
Stress				
Urban-rural subgroup				
UU		Ref.		
RU		0.51 (0.16, 1.66)	-1.12	0.265
RR		0.61 (0.23, 1.62)	-0.99	0.323

RR, rural hukou and rural school group; RU, rural hukou and urban school group; UU, urban hukou and urban school group.

¹ All models were adjusted for sociodemographic characteristics (i.e., age, sex, parental education level, and gross family income) and individual behaviors (screen time, night sleep duration, and physical activity).

The bold words represent the P values less than 0.05.